CLAIMS

What we claim is:

1. A fuel cell stack assembly, comprising:

a plurality of fuel cell assemblies, each of the fuel cell assemblies comprising:

a first flow field plate;

a second flow field plate; and

a membrane electrode assembly (MEA) provided between the first and second flow field plates and having an active area;

a plurality of registration apertures defined in each of the MEA, the first flow field plate, and the second flow field plate, the respective registration apertures situated within non-active areas of the MEA when the first and second flow field plates and the MEA are axially aligned within the stack assembly, the registration apertures having an inner surface; and

a plurality of registration posts configured for reception within the plurality of registration apertures, each of the registration posts having an outer surface differing in shape from a shape of the inner surface of the registration apertures, the inner surface of the registration apertures contacting the outer surface of the registration posts at a plurality of discrete press-fit locations.

2. The assembly of claim 1, wherein the shape of at least one of the inner surface of the registration apertures and the outer surface of the registration posts defines a convex curved shape.

3. The assembly of claim 1, wherein the shape of at least one of the inner surface of the registration apertures and the outer surface of the registration posts defines a circular or an elliptical shape.

4. The assembly of claim 1, wherein the shape of at least one of the inner surface of the registration apertures and the outer surface of the registration posts defines a generally curved shape comprising a plurality of concave or protruding portions.

5. The assembly of claim 1, wherein the shape of at least one of the inner surface of the registration apertures and the outer surface of the registration posts defines a polygon.

6. The assembly of claim 1, wherein the shape of one of the inner surface of the registration apertures and the outer surface of the registration posts defines a polygon, and the shape of the other of the inner surface of the registration apertures and the outer surface of the registration posts defines a circle or an ellipse.

7. The assembly of claim 1, wherein the shape of one of the inner surface of the registration apertures and the outer surface of the registration posts defines a first polygon, and the shape of the other of the inner surface of the registration apertures and the outer surface of the registration posts defines a second polygon.

8. The assembly of claim 1, wherein the shape of one of the inner surface of the registration apertures and the outer surface of the registration posts defines a circle, and the shape of the other of the inner surface of the registration apertures and the outer surface of the registration posts defines an ellipse.

9. The assembly of claim 1, wherein the shape of the inner surface of the registration apertures defines a triangle, and the outer surface of the registration posts defines a circle.

10. The assembly of claim 1, wherein the shape of the inner surface of the registration apertures defines a circle, and the registration posts defines a core member and a plurality of protrusions outwardly projecting from the core member.

11. The assembly of claim 1, wherein the registration posts comprise a solid core member.

12. The assembly of claim 1, wherein the registration posts comprise a hollow core member.

13. The assembly of claim 1, wherein the registration posts comprise a hollow outer member and a solid core member, the hollow outer member configured to receive the solid core member.

14. The assembly of claim 1, wherein the registration posts comprise a compressible hollow outer member and a solid core member, the solid core member having an outer diameter greater than an inner diameter of the hollow outer member, the solid core member compressibly deforming the hollow outer member when the solid core member is positioned within the hollow outer member.

15. The assembly of claim 1, wherein the fuel cell stack assembly comprises sets of the fuel cell assemblies and sets of registration posts, each of the registration post sets associated with two or more of the fuel cell assembly sets.

16. The assembly of claim 1, wherein each of the registration posts extends between opposing end plates of the fuel cell stack.

17. The assembly of claim 1, wherein the registration apertures of the first and second flow field plates comprise an entrance lead-in and an exit lead-in.

18. The assembly of claim 1, wherein protrusion of the registration posts from a first fuel cell assembly facilitates identification of the second flow field plate of the first fuel cell assembly as an anode plate or a cathode plate of the first fuel cell assembly.

19. The assembly of claim 1, further comprising an automobile, wherein one or more of the fuel cell stack assemblies are incorporated in a fuel cell power unit configured to supply power to the automobile.

20. The assembly of claim 1, further comprising a computer, wherein one or more of the fuel cell stack assemblies are incorporated in a fuel cell power unit configured to supply power to the computer.

21. The assembly of claim 1, wherein one or more of the fuel cell stack assemblies are incorporated in a fuel cell power supply configured to supply power to a load.

22. The assembly of claim 1, further comprising an auxiliary power system, wherein one or more of the fuel cell stack assemblies are incorporated in a fuel cell power unit configured to supply power to the auxiliary power system.

23. The assembly of claim 1, further comprising a residential heat and electricity cogeneration unit, wherein one or more of the fuel cell stack assemblies are incorporated in a fuel cell power unit configured to supply power to the residential heat and electricity cogeneration unit.

24. A fuel cell stack assembly, comprising:

a plurality of fuel cell assemblies, each of the fuel cell assemblies comprising:

a first flow field plate;

a second flow field plate; and

a membrane electrode assembly (MEA) provided between the first and second flow field plates and having an active area;

a plurality of registration apertures defined in each of the MEA, the first flow field plate, and the second flow field plate, the respective registration apertures situated within non-active areas of the MEA when the first and second flow field plates and the MEA are axially aligned within the stack assembly; and

a plurality of registration posts configured for reception within the plurality of registration apertures, each of the registration posts having a length greater than a height of individual fuel cell assemblies, but less than a total height of the plurality of fuel cell assemblies defining the fuel cell stack assembly.

25. The assembly of claim 24, wherein the registration posts have a length greater than the height of a single fuel cell assembly, but less than a total height of two of the fuel cell assemblies.

26. The assembly of claim 24, wherein the registration posts have a length greater than the height of a single fuel cell assembly, but less than a total height of between two and five of the fuel cell assemblies.

27. The assembly of claim 24, wherein the registration posts have a length greater than the height of a two or more fuel cell assemblies, but less than the total length of the plurality of fuel cell assemblies defining the fuel cell stack assembly.

28. The assembly of claim 24, wherein each of the registration posts extends through a portion of the first flow field plate, the MEA, and the second

flow field plate of a first fuel cell assembly and into, but not beyond, a second fuel cell assembly positioned adjacent the first fuel cell assembly.

29. The assembly of claim 28, wherein each of the registration posts extends into, but not beyond, a portion of the first flow field plate of the second fuel cell assembly.

30. The assembly of claim 28, wherein the registration posts of the first fuel cell assembly facilitate registration between the first fuel cell assembly and the first flow field plate of the second fuel cell assembly.

31. The assembly of claim 28, wherein the registration posts of the first fuel cell assembly facilitate registration of the first flow field plate, the second flow field plate, and the MEA within the first fuel cell assembly.

32. The assembly of claim 24, wherein the registration posts protruding from a first fuel cell assembly facilitate registration between the first fuel cell assembly and a second fuel cell assembly positioned adjacent the first fuel cell assembly.

33. The assembly of claim 24, wherein the registration posts protruding from a first set of fuel cell assemblies facilitate registration between the first set of fuel cell assemblies and a second set of fuel cell assemblies positioned adjacent the first set of fuel cell assemblies.

34. The assembly of claim 24, wherein protrusion of the registration posts from a first fuel cell assembly facilitates identification of the second flow field plate of the first fuel cell assembly as an anode plate or a cathode plate of the first fuel cell assembly.

35. The assembly of claim 24, wherein each of the registration posts has an outer surface having a shape and each of the registration apertures has an inner surface and a shape, the shape of the outer surface of the registration posts differing from the shape of the inner surface of the registration apertures, the inner surface of the registration apertures contacting the outer surface of the registration posts at a plurality of press-fit locations.

36. A fuel cell stack assembly, comprising:

a plurality of fuel cell assemblies, each of the fuel cell assemblies comprising:

a first flow field plate;

a second flow field plate; and

a membrane electrode assembly (MEA) provided between the first and second flow field plates and having an active area;

a plurality of registration apertures defined in each of the MEA, the first flow field plate, and the second flow field plate, the respective registration apertures situated within non-active areas of the MEA when the first and second flow field plates and the MEA are axially aligned within the stack assembly; and

a plurality of registration posts configured for reception within the plurality of registration apertures, at least some of the registration apertures of the first flow field plates configured to receive two registration posts, and at least some of the registration apertures of the second flow field plates configured to receive one registration post.

37. The assembly of claim 36, wherein each of the registration apertures of the first flow field plates is configured to receive two registration posts and each of the registration apertures of the second flow field plates is configured to receive one registration post.

38. The assembly of claim 36, wherein the registration posts of a first fuel cell assembly facilitate registration between the first fuel cell assembly and a second fuel cell assembly positioned adjacent the first fuel cell assembly.

39. The assembly of claim 36, wherein the registration posts of a first set of fuel cell assemblies facilitate registration between the first set of fuel cell assemblies and a second set of fuel cell assemblies positioned adjacent the first set of fuel cell assemblies.

40. The assembly of claim 36, wherein the registration posts of a first fuel cell assembly facilitate registration between the first fuel cell assembly and the first flow field plate of a second fuel cell assembly positioned adjacent the first fuel cell assembly.

41. The assembly of claim 36, wherein the registration posts of a first fuel cell assembly facilitate registration of the first flow field plate, the second flow field plate, and the MEA within the first fuel cell assembly.

42. The assembly of claim 36, wherein protrusion of the registration posts from the second flow field plate of a first fuel cell assembly facilitates identification of the second flow field plate as an anode or a cathode plate of the first fuel cell assembly.

43. The assembly of claim 36, wherein each of the registration posts has an outer surface having a shape and each of the registration apertures has an inner surface and a shape, the shape of the outer surface of the registration posts differing from the shape of the inner surface of the registration apertures, the inner surface of the registration apertures contacting the outer surface of the registration posts at a plurality of discrete press-fit locations.

44. A fuel cell sub-assembly for incorporation in a fuel cell stack assembly, comprising:

a flow field plate;

a membrane electrode assembly (MEA) positioned adjacent the flow field plate and having an active area;

a plurality of registration apertures defined in each of the flow field plate and the MEA, the respective registration apertures situated within non-active areas of the MEA when the flow field plate and the MEA are in axial alignment, the registration apertures having an inner surface; and

a plurality of registration posts configured for reception within the plurality of registration apertures, each of the registration posts having an outer surface differing in shape from a shape of the inner surface of the registration apertures, the inner surface of the registration apertures contacting the outer surface of the registration posts at a plurality of discrete press-fit locations.

45. The sub-assembly of claim 44, wherein the flow field plate is configured as a bipolar flow field plate.

46. The sub-assembly of claim 44, wherein the shape of at least one of the inner surface of the registration apertures and the outer surface of the registration posts defines a convex curved shape.

47. The sub-assembly of claim 44, wherein the shape of at least one of the inner surface of the registration apertures and the outer surface of the registration posts defines a circular or an elliptical shape.

48. The sub-assembly of claim 44, wherein the shape of at least one of the inner surface of the registration apertures and the outer surface of the registration posts defines a generally curved shape comprising a plurality of concave or protruding portions.

49. The sub-assembly of claim 44, wherein the shape of at least one of the inner surface of the registration apertures and the outer surface of the registration posts defines a polygon.

50. The sub-assembly of claim 44, wherein the shape of one of the inner surface of the registration apertures and the outer surface of the registration posts defines a polygon, and the shape of the other of the inner surface of the registration apertures and the outer surface of the registration posts defines a circle or an ellipse.

51. The sub-assembly of claim 44, wherein the shape of one of the inner surface of the registration apertures and the outer surface of the registration posts defines a first polygon, and the shape of the other of the inner surface of the registration apertures and the outer surface of the registration posts defines a second polygon.

52. The sub-assembly of claim 44, wherein the shape of one of the inner surface of the registration apertures and the outer surface of the registration posts defines a triangle, and the shape of the other of the inner surface of the registration apertures and the outer surface of the registration posts defines a circle.

53. The sub-assembly of claim 44, wherein the registration posts comprise a solid core member.

54. The sub-assembly of claim 44, wherein the registration posts comprise a hollow core member.

55. The sub-assembly of claim 44, wherein the registration posts comprise a hollow outer member and a solid core member, the hollow outer member configured to receive the solid core member.

56. The sub-assembly of claim 44, wherein the registration apertures of the flow field plate comprise an entrance lead-in and an exit lead-in.

57. The sub-assembly of claim 44, wherein the registration posts have a length greater than a total height of the flow field plate and MEA.

58. The sub-assembly of claim 44, wherein the registration posts have a length greater than a total height of the flow field plate and MEA, but less than a total height of two sets of the flow field plates and MEAs.

59. The sub-assembly of claim 44, wherein the registration posts have a length greater than a total height of two sets of the flow field plates and MEAs, but less than a total height of 5 sets of the flow field plates and MEAs.

60. The sub-assembly of claim 44, wherein the registration posts have a length greater than a total height of more than two sets of the flow field plates and MEAs.

61. The sub-assembly of claim 44, wherein each of the registration posts extends through a portion of the flow field plate, the MEA, and at least a portion of a flow field plate of an adjacently positioned fuel cell sub-assembly.

62. The sub-assembly of claim 44, wherein the registration posts of a first fuel cell sub-assembly facilitate registration between the first fuel cell sub-assembly and a flow field plate of a second fuel cell sub-assembly.

63. The sub-assembly of claim 44, wherein protrusion of the registration posts from a first fuel cell sub-assembly facilitates identification of the flow field plate of the first fuel cell sub-assembly as an anode plate or a cathode plate of the first fuel cell sub-assembly.

64. A fuel cell stack assembly, comprising:

a plurality of fuel cell assemblies, each of the fuel cell assemblies comprising:

a first flow field plate;

a second flow field plate; and

a membrane electrode assembly (MEA) provided between the first and second flow field plates and having an active area;

a plurality of registration apertures defined in each MEA,

a plurality of registration recesses molded into a first surface of each of the first and second flow field plates; and

a plurality of registration posts molded into a second surface of each of the first and second flow field plates, the respective registration apertures, recesses, and posts situated within non-active areas of the MEA when the first and second flow field plates and the MEA are axially aligned within the stack assembly, the registration posts of the first flow field plate extending through the registration apertures of the MEA and into the registration recesses of the second flow field plate of a first fuel cell assembly, respectively, and the registration posts of the second flow field plate of the first fuel cell assembly extending into the registration recesses of the first flow field plate of a second fuel cell assembly positioned adjacent the first fuel cell assembly.

65. The assembly of claim 64, wherein the registration posts of the second flow field plate of the first fuel cell assembly facilitate registration between the first fuel cell assembly and the second fuel cell assembly.

66. The assembly of claim 64, wherein the registration posts of the second flow field plate of the first fuel cell assembly facilitate registration between the first fuel cell assembly and the registration recesses of the first flow field plate of the second fuel cell assembly.

67. The assembly of claim 64, wherein the registration posts of the first flow field plates facilitate registration between the first flow field plate, the MEA, and the second flow field plate of each of the fuel cell assemblies.

68. The assembly of claim 64, wherein the registration posts of the first flow field plates facilitate registration between the first flow field plate, the MEA, and the second flow field plate of each of the fuel cell assemblies.

69. The assembly of claim 64, wherein protrusion of the registration posts from the second flow field plate of the first fuel cell assembly facilitates identification of the second flow field plate as an anode plate of the first fuel cell assembly.

70. The assembly of claim 64, wherein protrusion of the registration posts from the second flow field plate of the first fuel cell assembly facilitates identification of the second flow field plate as a cathode plate of the first fuel cell assembly.

71. A method of forming a fuel cell stack assembly, comprising:

providing a first flow field plate, a second flow field plate, and a membrane electrode assembly (MEA) having an active area, a plurality of registration apertures defined in each of the MEA, the first flow field plate, and the second flow field plate;

aligning the first and second flow field plates and the MEA so that the respective registration apertures are in axial alignment, the registration apertures having an inner surface;

providing a plurality of registration posts having an outer surface differing in shape from a shape of the inner surface of the registration apertures; and

inserting the plurality of registration posts into the plurality of registration apertures so that the inner surface of the registration apertures

contact the outer surface of the registration posts at a plurality of discrete press-fit locations.

72. The method of claim 71, wherein the registration posts each comprise a hollow outer member and a solid core member, the method further comprising inserting the hollow outer members into the registration apertures and inserting the solid core members into the hollow outer members.

73. The method of claim 71, wherein the registration posts each comprise a hollow outer member and a solid core member, the solid core member having an outer diameter greater than an inner diameter of the hollow outer member, the method further comprising inserting the hollow outer members into the registration apertures and inserting the solid core members into the hollow outer members to compressibly deform the hollow outer members.

74. The method of claim 71, wherein the shape of at least one of the inner surface of the registration apertures and the outer surface of the registration posts defines a circular or an elliptical shape.

75. The method of claim 71, wherein the shape of at least one of the inner surface of the registration apertures and the outer surface of the registration posts defines a generally curved shape comprising a plurality of concave or protruding portions.

76. The method of claim 71, wherein the shape of at least one of the inner surface of the registration apertures and the outer surface of the registration posts defines a polygon.

77. The method of claim 71, wherein the shape of one of the inner surface of the registration apertures and the outer surface of the registration posts defines a polygon, and the shape of the other of the inner surface of the

registration apertures and the outer surface of the registration posts defines a circle or an ellipse.

78. A method of forming a fuel cell stack assembly, comprising:

providing a plurality of fuel cell assemblies each comprising a first flow field plate, a second flow field plate, and a membrane electrode assembly (MEA) having an active area, a plurality of registration apertures defined in each of the MEA, the first flow field plate, and the second flow field plate;

aligning the first and second flow field plates and the MEAs so that the respective registration apertures are in axial alignment;

providing a plurality of registration posts each having a length exceeding a height of individual fuel cell assemblies; and

inserting the plurality of registration posts into the plurality of registration apertures so that each of the registration posts extends through some but not all of the fuel cell assemblies defining the fuel cell stack assembly.

79. The method of claim 78, wherein inserting comprises inserting the plurality of registration posts into the plurality of registration apertures so that each of the registration posts extends through a portion of the first flow field plate, the MEA, and the second flow field plate of a first fuel cell assembly and into, but not beyond, a second fuel cell assembly positioned adjacent the first fuel cell assembly.

80. The method of claim 78, wherein inserting further comprises:

inserting a first set of the registration posts into the registration apertures of a first set of fuel cell assemblies;

inserting a second set of the registration posts into the registration apertures of a second set of fuel cell assemblies; and

positioning the second set of fuel cell assemblies relative to the first set of fuel cell assemblies so that the registration posts of the first set of fuel cell

assemblies are received by registration apertures of the second set of fuel cell assemblies.

81. The method of claim 78, wherein each of the registration posts has an outer surface having a shape and each of the registration apertures has an inner surface and a shape, the shape of the outer surface of the registration posts differing from the shape of the inner surface of the registration apertures, the inner surface of the registration apertures contacting the outer surface of the registration posts at a plurality of discrete press-fit locations.

82. A method of forming a fuel cell stack assembly, comprising:

providing a plurality of fuel cell assemblies each comprising a first flow field plate, a second flow field plate, and a membrane electrode assembly (MEA) having an active area, a plurality of registration apertures defined in each of the MEA, the first flow field plate, and the second flow field plate;

aligning the first and second flow field plates and the MEA so that the respective registration apertures are in axial alignment;

providing a plurality of registration posts; and

inserting the plurality of registration posts into the plurality of registration apertures so that at least some of the registration apertures of the first flow field plates receive two registration posts, and at least some of the registration apertures of the second flow field plates receive one registration post.

83. The method of claim 82, wherein inserting comprises inserting the registration posts into the registration apertures so that each of the registration apertures of the first flow field plates receive two registration posts, and each of the registration apertures of the second flow field plates receive one registration post.

84. The method of claim 82, wherein inserting the registration posts of a first fuel cell assembly facilitates registration between the first fuel cell assembly and a second fuel cell assembly positioned adjacent the first fuel cell assembly.

85. The method of claim 82, wherein inserting the registration posts of a first fuel cell assembly facilitates registration between the first fuel cell assembly and the first flow field plate of a second fuel cell assembly positioned adjacent the first fuel cell assembly.

86. The method of claim 82, wherein inserting the registration posts facilitates registration of the first flow field plate, the second flow field plate, and the MEA within each of the fuel cell assemblies.

87. A method of forming a fuel cell stack assembly, comprising:

providing a plurality of fuel cell assemblies each comprising a first flow field plate, a second flow field plate, and a membrane electrode assembly (MEA) having an active area, a plurality of registration apertures defined in each MEA, a plurality of registration recesses molded into a first surface of each of the first and second flow field plates, and a plurality of registration posts molded into a second surface of each of the first and second flow field plates;

aligning the first and second flow field plates and the MEA so that the registration apertures, registration posts, and registration recesses are in axial alignment; and

arranging first and second fuel cell assemblies of the fuel cell stack assembly so that the registration posts of the first flow field plate extend through the registration apertures of the MEA and into the registration recesses of the second flow field plate of the first fuel cell assembly, respectively, and the registration posts of the second flow field plate of the first fuel cell assembly extend into the registration recesses of the first flow field plate of the second fuel cell assembly positioned adjacent the first fuel cell assembly.

88. The method of claim 87, wherein arranging comprises arranging the first and second fuel cell assemblies so that the registration posts of the second flow field plate of the first fuel cell assembly facilitate registration between the first fuel cell assembly and the second fuel cell assembly.

89. The method of claim 87, wherein arranging comprises arranging the first and second fuel cell assemblies so that the registration posts of the second flow field plate of the first fuel cell assembly facilitate registration between the first fuel cell assembly and the registration recesses of the first flow field plate of the second fuel cell assembly.

90. The method of claim 87, wherein arranging comprises arranging the first and second fuel cell assemblies so that the registration posts of the first flow field plates facilitate registration between the first flow field plate, the MEA, and the second flow field plate of each of the fuel cell assemblies.